

WHAT IS CLAIMED IS:

1. A method of expediting the analysis of a sample containing at least one relevant low-boiling component and at least one relevant high-boiling component comprising:
 - 5 a) fractionating the sample in a fractionation zone at fractionation conditions to obtain a low-boiling fraction containing the at least one relevant low-boiling component and a high-boiling fraction containing the at least one relevant high-boiling component;
 - b) analyzing the low-boiling fraction in a first analysis zone at first analysis
10 conditions to determine one or both of the presence and concentration at least one relevant low-boiling component; and,
 - c) analyzing the high-boiling fraction in a second analysis zone at second analysis conditions to determine one or both of the presence and concentration of at least one relevant high-boiling component.
- 15 2. The method of Claim 1 wherein at least one of the first analysis zone and second analysis zone comprise one or more of gas chromatography, liquid chromatography, flame ionization detection, flame emission detection, thermal conductivity detection, electron capture detection, infrared absorption spectroscopy, Raman spectroscopy, ultraviolet absorption spectroscopy, visible absorption
20 spectroscopy, fluorescence spectroscopy, infrared thermography, nuclear magnetic resonance, emission spectroscopy, and mass spectrometry, as well as other radiochemical methods, electroanalytical methods, potentiometric methods,

conductometric methods, electrogravimetric methods, coulometric methods, voltammetry and combinations thereof.

3. The method of Claim 2 wherein at least one of the first analysis zone and second analysis zone comprise gas chromatography plus one or more of of flame
5 ionization detection, flame emission detection, thermal conductivity detection, pulse discharge detection and election capture detection.

4. A method of expediting the analysis of a sample containing at least one relevant low-boiling component and at least one relevant high-boiling component comprising:

- 10 a) fractionating the sample in a fractionation zone comprising gas chromatography at fractionation conditions to obtain a low-boiling fraction as elutrate containing the at least one relevant low-boiling component and a high-boiling fraction through backflushing containing the at least one relevant high-boiling component;
- b) analyzing the low-boiling fraction in a first analysis zone comprising gas
15 chromatography at first analysis conditions to determine one or both of the presence and concentration of at least one relevant low-boiling component; and,
- c) analyzing the high-boiling fraction in a second analysis zone at second analysis conditions to determine one or both of the presence and concentration of at least one relevant high-boiling component.

20 5. The method of Claim 4 wherein the second analysis zone comprises gas chromatography.

6. The method of Claim 5 wherein at least one of the first analysis zone and second analysis zone comprise one or more of flame ionization detection, flame emission detection, thermal conductivity detection, pulse discharge detection and electron capture detection.
- 5 7. The method of Claim 4 wherein the fractionation conditions comprise isothermal conditions.
8. The method of Claim 7 wherein one or both of the first and second analysis conditions comprise isothermal conditions.
9. The method of Claim 4 further comprising fractionating the low-boiling
10 component in a sequential fractionation zone to separate the low-boiling fraction at sequential fractionation conditions to obtain a lower-boiling fraction containing the at least one relevant low-boiling component and an intermediate fraction containing at least one relevant intermediate component and analyzing the lower-boiling and intermediate fractions in sequential analysis zones to determine one or both of the
15 presence and concentration of respective relevant low-boiling and intermediate components.
10. The method of Claim 9 further comprising between two and ten sequential fractionation and analysis zones.
11. The method of Claim 4 further comprising fractionating the high-boiling
20 component in a sequential fractionation zone which separates the high-boiling fraction at sequential fractionation conditions to obtain a higher-boiling fraction containing at least one relevant high-boiling component and an intermediate fraction containing at

least one relevant intermediate component and analyzing the higher-boiling and intermediate fractions in a sequential analysis zone to determine one or both of the presence and concentration of respective relevant high-boiling and intermediate components.

5 12. The method of Claim 11 further comprising between two and 100 sequential fractionation and analysis zones.

13. A method of expediting the analysis of a sample containing at least one relevant low-boiling component and at least one relevant high-boiling component comprising:

10 a) fractionating the sample in a fractionation zone comprising gas chromatography at fractionation conditions to obtain a low-boiling fraction as eluate containing the at least one relevant low-boiling component and a high-boiling fraction through backflushing containing the at least one relevant high-boiling component;

15 b) analyzing the low-boiling fraction in a first analysis zone at first analysis conditions to determine one or both of the presence and concentration of at least one relevant low-boiling component; and,

16 c) analyzing the high-boiling fraction in a second analysis zone comprising gas chromatography at second analysis conditions to determine one or both of the presence and concentration of at least one relevant high-boiling component.

20 14. The method of Claim 13 wherein the first analysis zone comprises gas chromatography.

15. The method of Claim 14 wherein at least one of the first analysis zone and second analysis zone comprise one or more of flame ionization detection, flame emission detection, thermal conductivity detection, pulse discharge detection and election capture detection.
- 5 16. The method of Claim 13 wherein the fractionation conditions comprise isothermal conditions.
17. The method of Claim 16 wherein one or both of the first and second analysis conditions comprise isothermal conditions.
18. The method of Claim 13 further comprising fractionating the high boiling
10 component in a sequential fractionation zone to separate the high-boiling fraction at sequential fractionation conditions to obtain a higher-boiling fraction containing at least one relevant high-boiling component and an intermediate fraction containing at least one relevant intermediate component and analyzing the higher-boiling and intermediate fractions in sequential analysis zones to determine one or both of the
15 presence and concentration of respective relevant high-boiling and intermediate components.
19. The method of Claim 18 further comprising between two and ten sequential fractionation and analysis zones.
20. A method of expediting the analysis of a sample containing at least one
20 relevant low-boiling component and at least one relevant high-boiling component comprising:

- a) fractionating the sample in a fractionation zone comprising gas chromatography at fractionation conditions to obtain a low-boiling fraction as eluate containing the at least one relevant low-boiling component and a high-boiling fraction through backflushing containing the at least one relevant high-boiling component;
- 5 b) fractionating the low-boiling component in a sequential fractionation zone which separates the low-boiling fraction at sequential fractionation conditions to obtain a lower-boiling fraction containing the at least one relevant low-boiling component and an intermediate fraction containing at least one relevant intermediate component;
- 10 c) analyzing the lower-boiling fraction in a first analysis zone comprising gas chromatography at first analysis conditions to determine one or both of the presence and concentration of at least one relevant low-boiling component; and,
- d) analyzing the high-boiling fraction in a second analysis zone at second analysis conditions to determine one or both of the presence and concentration of at least one
- 15 relevant high-boiling component.

21. The method of Claim 20 wherein the second analysis zone comprises gas chromatography.

22. The method of Claim 20 wherein at least one of the first analysis zone and second analysis zone comprise one or more of flame ionization detection, flame

20 emission detection, thermal conductivity detection, pulse discharge detection, electron capture detection, infrared absorption spectroscopy, Raman spectroscopy, distillation measurement, nuclear magnetic resonance, and mass spectrometry.

23. The method of Claim 20 wherein the fractionation conditions, the sequential fractionation conditions and the first analysis conditions comprise isothermal conditions.

24. The method of Claim 23 wherein the fractionation conditions comprise a higher temperature than that of the sequential fractionation conditions, and the sequential fractionation conditions comprise a higher temperature than that of the first analysis conditions.

25. A method of expediting the analysis of a plurality of samples containing at least one relevant low-boiling component and at least one relevant high-boiling component comprising:

a) fractionating the plurality of samples in a fractionation zone comprising gas chromatography at fractionation conditions to obtain a plurality of low-boiling fractions as eluate containing the at least one relevant low-boiling component and a plurality of high-boiling fractions as backflush containing the at least one relevant

high-boiling component;

b) analyzing the plurality of low-boiling fractions sequentially in a first analysis zone comprising gas chromatography at first analysis conditions to determine one or both of the presence and concentration of at least one relevant low-boiling component; and,

c) analyzing the plurality of high-boiling fractions sequentially in a second analysis zone at second analysis conditions to determine one or both of the presence and concentration of at least one relevant high-boiling component.

26. The method of Claim 25 wherein the second analysis zone comprises gas chromatography.
27. The method of Claim 25 wherein at least one of the first analysis zone and second analysis zone comprise one or more of flame ionization detection, flame
5 emission detection, thermal conductivity detection, pulse discharge detection, electron capture detection, infrared absorption spectroscopy, Raman spectroscopy, distillation measurement, nuclear magnetic resonance, and mass spectrometry.
28. The method of Claim 25 wherein the fractionation conditions comprise isothermal conditions.
- 10 29. The method of Claim 25 wherein one or both of the first and second analysis conditions comprise isothermal conditions.
30. The method of Claim 25 further comprising reacting a plurality of feedstocks at reaction conditions in a reaction zone comprising an array of reactors to obtain a plurality of samples.
- 15 31. A method of assessing a plurality of materials comprising:
- a) reacting a plurality of feedstocks at reaction conditions in a reaction zone comprising an array of reactors to obtain a plurality of samples;
 - b) directing the samples to a sampling valve to sequence the samples;
 - c) fractionating the plurality of samples sequentially in a fractionation zone
- 20 comprising gas chromatography at fractionation conditions to obtain a plurality of low-boiling fractions as eluate containing the at least one relevant low-boiling

component and a plurality of high-boiling fractions as backflush containing the at least one relevant high-boiling component;

d) analyzing the plurality of low-boiling fractions sequentially in a first analysis zone comprising gas chromatography at first analysis conditions to determine one or

5 both of the presence and concentration of at least one relevant low-boiling component;

and,

e) analyzing the plurality of high-boiling fractions sequentially in a second analysis zone at second analysis conditions to determine one or both of the presence and concentration of at least one relevant high-boiling component.